

GIS and Demographic Data in Emergency Management

Demography Annual Meeting

November 18, 2005



Topics

- ❖ Use of demographic data in emergency management
- ❖ Types of population data used
- ❖ Analysis of population data
- ❖ Issues related to demographic data in emergency mgt.
- ❖ Example
- ❖ State activities in GIS for emergency management



Uses of Demographic Data

- ❖ Planning resource needs
 - ❖ Number of resources
 - ❖ Type of resources
- ❖ Evacuation
 - ❖ Assistance
 - ❖ Notification
 - ❖ Traffic volume
- ❖ Damage assessment – compensation
- ❖ Reentry/recovery



Types of Population Information

- ❖ Population count
- ❖ Demographics
 - ❖ Age
 - ❖ Auto-ownership
 - ❖ Economics (median income)
 - ❖ Language
- ❖ Special needs populations
 - ❖ Nursing homes
 - ❖ Day cares
 - ❖ Schools
 - ❖ Hospitals
- ❖ Seasonal/daily variation (day vs. night population)



Questions to be Addressed in EM

- ❖ How many people are impacted at various times of day/week/year
- ❖ How many people will have to evacuate
- ❖ How many people will have to evacuate/shelter
- ❖ Are there clusters of people requiring specific actions
- ❖ Where are automobiles getting on “evacuation network”
- ❖ What is distribution of cars on network
- ❖ Where is congestion on evacuation network
- ❖ Where and how many people require assistance for protective actions



Analysis of Population

- ❖ Population variation
 - ❖ Diurnal
 - ❖ Weekly
 - ❖ Seasonal (special events)
- ❖ Spatial distribution of population
 - ❖ Clusters, areas of high population
- ❖ Loading on traffic network
 - ❖ Number of cars “loading onto” specific link in network
- ❖ Relationship between population and hazards
 - ❖ Number of people and demographic breakdown in hazard area



Issues Related to Population Data

- ❖ Scale/resolution
- ❖ Currentness
- ❖ Accuracy
 - ❖ Spatial
 - ❖ Nonspatial (attribute)
- ❖ 80% solution



Scale/Resolution Issues

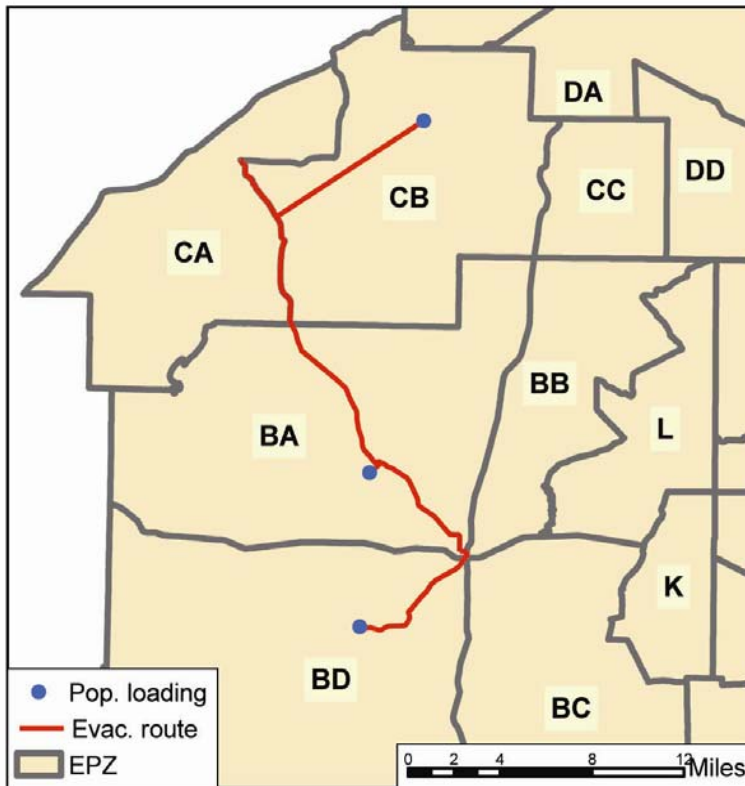
- ❖ Blocks vs. block groups vs. some other geography
- ❖ What is appropriate resolution
 - ❖ Precision vs. data availability and processing load
- ❖ Modifiable Area Unit Problem (MAUP)
 - ❖ Statistical results (particularly correlations) are influenced for scale of analysis



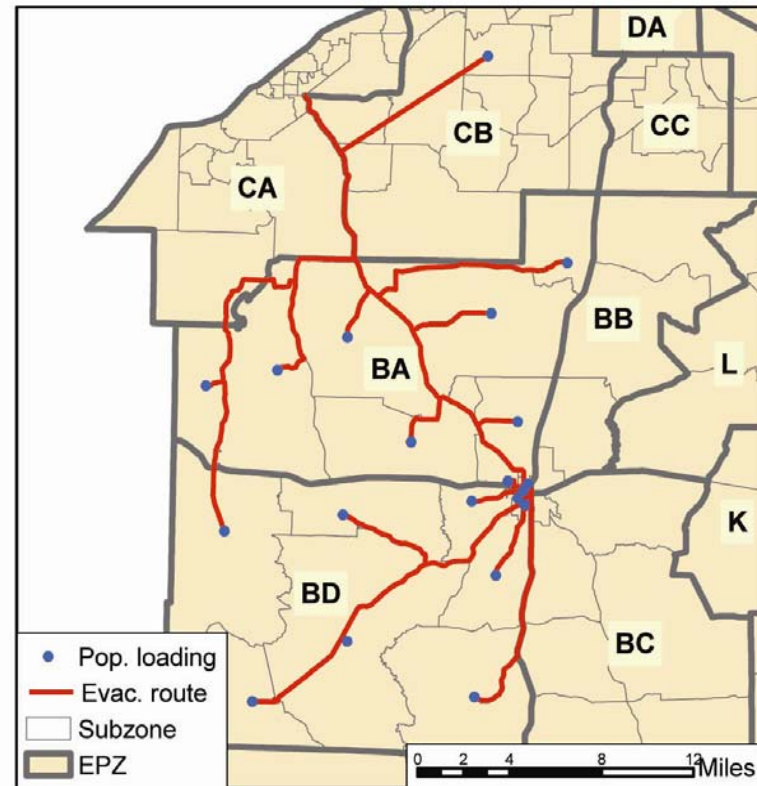
Resolution Issues in Evacuation Modeling

- ❖ Evacuation models “load” population onto network
- ❖ Population can be loaded based on road geometry or zonal geography
- ❖ Does disaggregating population and loading population based on smallest geographic unit possible influence model result?

Resolution in Evac. Modeling



A) Aggregated population loading/network



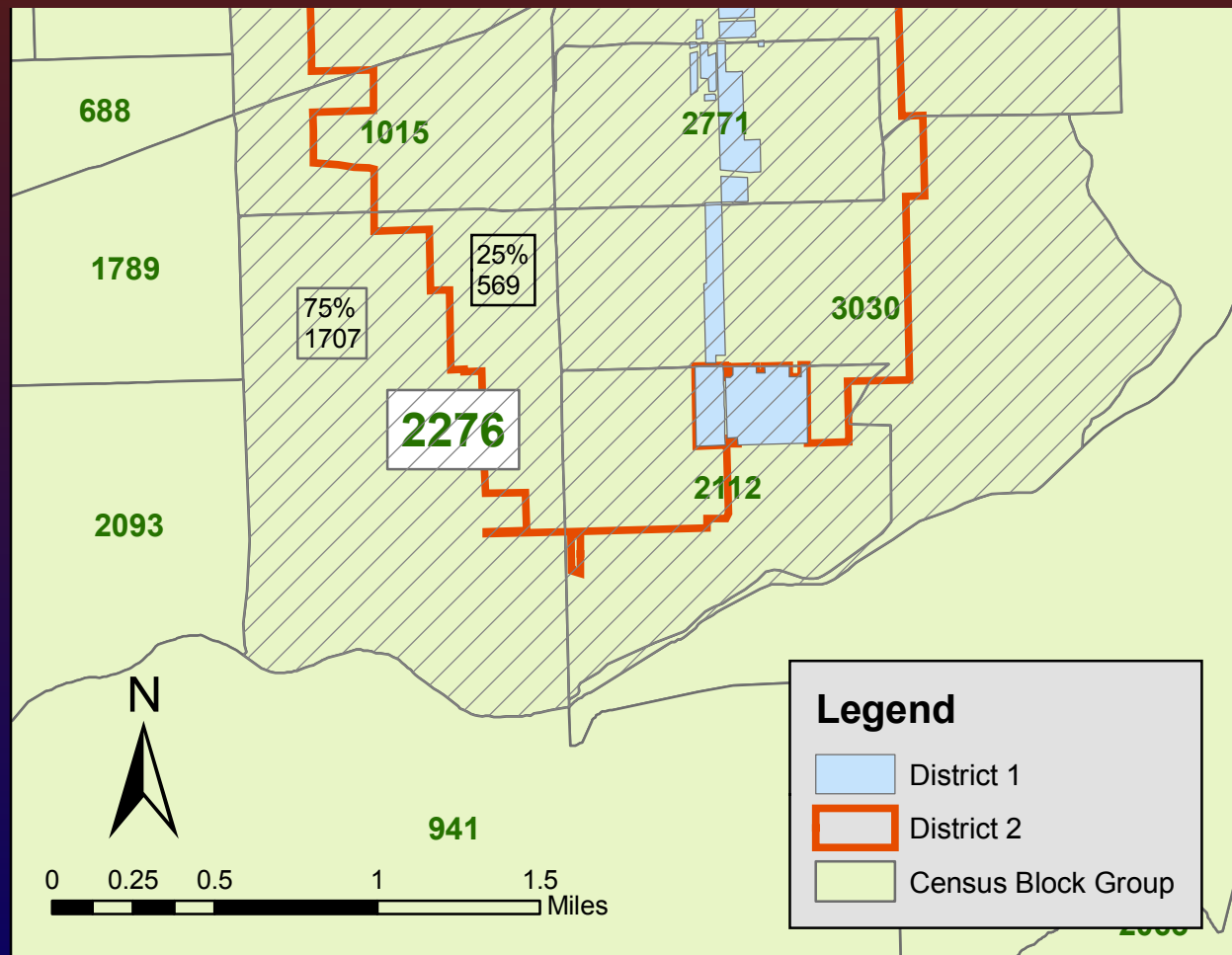
B) Disaggregated population loading/network
(Zone CB excluded from analysis)



Currentness Issues

- ❖ Census counts every 10 years
- ❖ Intercensal estimates
 - ❖ Estimate geography vs. census geography
 - ❖ Areal interpolation
 - ❖ Methods
 - ❖ Area-ratio method
 - ❖ Ancillary information
 - ❖ Assumptions
 - ❖ Smooth distribution of population
 - ❖ Continuous process
 - ❖ Lack of validation

Areal Interpolation






State activities in EM GIS

- ❖ Supporting state homeland security activities
 - ❖ State Multi-Agency Coordination Center/EOC
 - ❖ Critical Infrastructure Protection
 - ❖ CIAC
- ❖ Physical configuration of GIS in MACC:
 - ❖ 1 GIS workstation operated by GIS specialist
 - ❖ Centralized database using ArcSDE
 - ❖ Display from workstation can be projected at front of MACC
 - ❖ Web-based viewer of information for ERCs



Data

- ❖ GIS data needs from analysis of EOP
- ❖ Identified several large categories of data
 - ❖ Population
 - ❖ Land use
 - ❖ Transportation
 - ❖ Utilities
 - ❖ Boundaries
 - ❖ Emergency Resources
 - ❖ Medical Resources
 - ❖ Special Facilities
- ❖ Data from variety of sources



Colorado

Click on the map to populate the X and Y

current active tool:
ADD EVENT
02:16:16 GMT

COORDINATES

104°59'11"W 039°37'43"N

current scale: 1 : 236,852

zoom to scale:

TABLE OF CONTENTS

RSS Legend Events Find

▼ Event Entry ▼

Add Modify Delete

NGA NSSE Event Form

Event Location (Click on map or enter)

X: Y:

Get Address Clear

Zoom to Point Clear Zoomed Point

Street:

Cross Street:

City:

State: Zip Code:

Get Coordinates Clear

Event Timestamp

Event Time:

Hour:Minute :

Timezone:

Event Type

Event Type:

Event List

Search
Utilities
Selection
Annotation
Measure
Output
Help

8

7

6

5


4

3


2

1

+



projection: Geographic -- Map: DMS 105°02'12"W 039°47'19"N -- DD Long -105.0367, Lat 39.7885



Colorado

COORDINATES
104°59'11"W 039°37'43"N
current scale: 1 : 236,852
zoom to scale: [dropdown]

TABLE OF CONTENTS

RSS Legend Events Find

Event Entry

Event List

Show All Events | Last 24 Hrs | Last 8 Hrs | Future

Show ☒ All ☒ New ☒ Modified ☒ Cleared

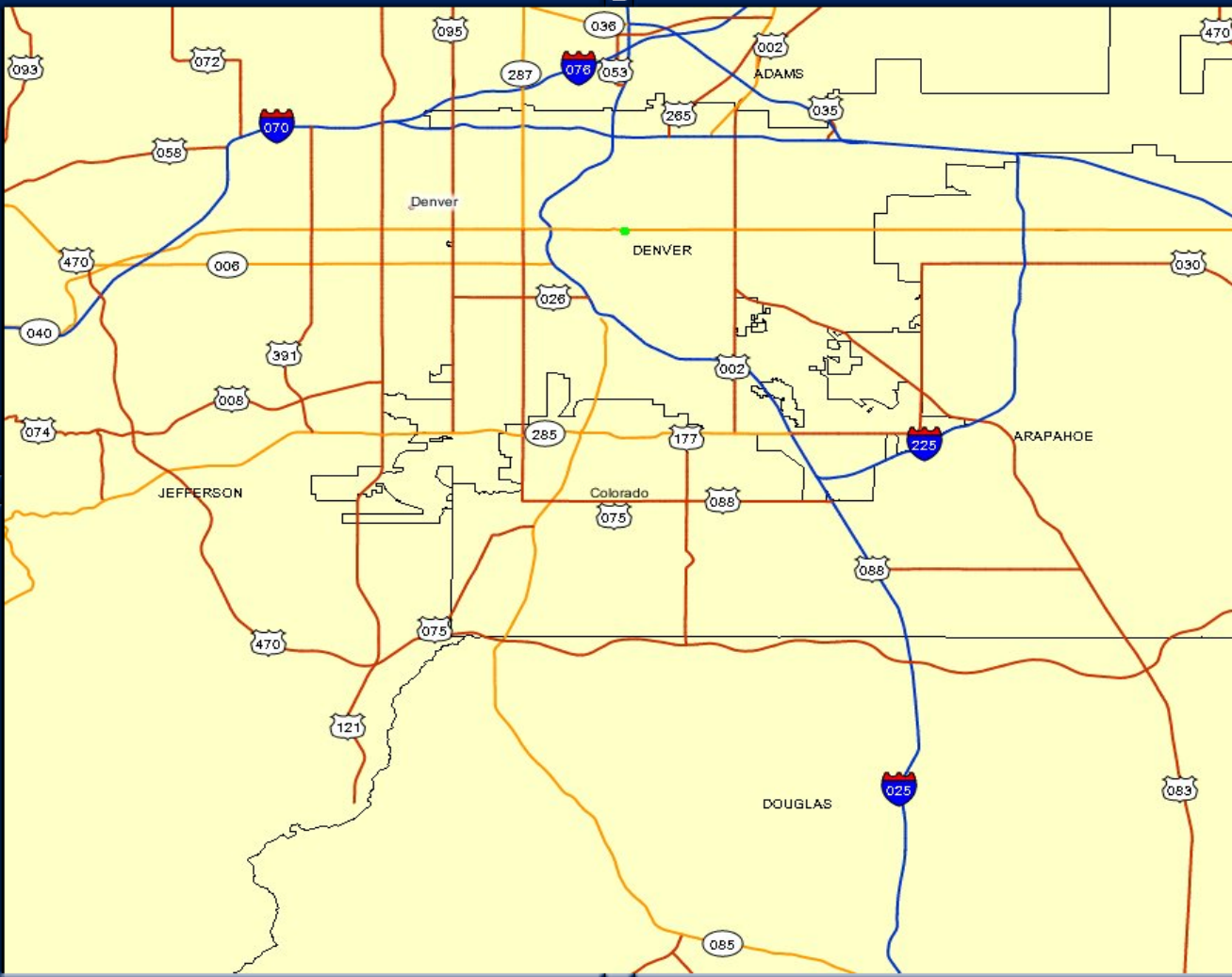
Level Color Low Medium High

Details	Event Id	Description	Status
	1692	First Aid Station: test	New
	1691	Traffic Incident: turck overturned	New
	1690	Suspicious Individual:	New
	1689	Crowd:	New
	1688	Crowd:	New
	1687	Crowd:	New
	1686	Crowd:	New
	1685	Crowd:	New
	1683	Crowd: Moffat County	New

current active tool: PAN 02:13:17 GMT

Search Utilities Selection Annotation Measure Output Help

Refresh Map



Pan the map in any direction by holding down [button]

Internet



Data Sharing

- ❖ Building a Common Operating Picture (COP)
- ❖ State building “regional” repository of data and making it available to local response agencies and other agencies involved in response
- ❖ Data will be available and shared through:
 - ❖ Web services
 - ❖ FTP
 - ❖ Email
- ❖ Developing mechanisms to translate data from local sources into unified, consistent data model
- ❖ Extract, Translate & Load (ETL)



Data Sharing Administrative Issues

- ❖ Data sharing agreements/restrictions
- ❖ Adequate compensation?
- ❖ How and when data will be shared
- ❖ Federal agencies?
- ❖ Leveraging grant awards to encourage cooperation/collaboration



Future Directions/Issues

- ❖ Collaborative projects/grant proposals
- ❖ DHS grants
- ❖ Federal (DHS) activities
- ❖ Data sharing obstacles
- ❖ Common base of expertise
 - ❖ Front range, SW and some west slope counties have mature, sophisticated systems



Statewide GIS Coordination

- ❖ Purchasing data, applications or services as one single enterprise
- ❖ Developing unified procedures and agreements for geospatial interaction among state agencies
- ❖ Leveraging federal grants to serve needs of several entities
- ❖ Providing a single source of information and contact for GIS – State GIS Portal
- ❖ Coordinating efforts that overlap several jurisdictions



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